



US00007408A

**United States Patent** [19]**Sandhu**[11] **Patent Number:** **6,007,408**[45] **Date of Patent:** **Dec. 28, 1999**

[54] **METHOD AND APPARATUS FOR  
ENDPOINTING MECHANICAL AND  
CHEMICAL-MECHANICAL POLISHING OF  
SUBSTRATES**

[75] **Inventor:** Gurtej S. Sandhu, Boise, Id.

[73] **Assignee:** Micron Technology, Inc., Boise, Id.

[21] **Appl. No.:** 08/917,665

[22] **Filed:** Aug. 21, 1997

[51] **Int. Cl.<sup>6</sup>** ..... **B24B 1/00**

[52] **U.S. Cl.** ..... **451/41; 451/7; 451/53**

[58] **Field of Search** ..... **451/7, 41, 53,  
451/285, 289, 8, 6, 5, 526, 921, 488; 438/612,  
604; 216/88, 89**

5,369,488 11/1994 Morokuma .  
5,413,941 5/1995 Koos et al. .  
5,433,651 7/1995 Lustig et al. .  
5,461,007 10/1995 Kobayashi .  
5,465,154 11/1995 Levy .  
5,597,442 1/1997 Chen et al. .... 451/7  
5,609,719 3/1997 Hempel .  
5,616,069 4/1997 Walker et al. .  
5,643,050 7/1997 Chen ..... 451/7  
5,663,797 9/1997 Sandhu .  
5,733,176 3/1998 Robinson et al. .... 451/41  
5,762,537 6/1998 Sandhu et al. .... 451/7  
5,777,739 7/1998 Sandhu et al. .  
5,855,804 1/1999 Walker .

*Primary Examiner*—Robert A. Rose

*Assistant Examiner*—George Nguyen

*Attorney, Agent, or Firm*—Dorsey & Whitney LLP

# **[57] ABSTRACT**

An apparatus and method for stopping mechanical and chemical-mechanical polishing of a substrate at a desired endpoint. In one embodiment, a polishing machine has a platen, a polishing pad positioned on the platen, and a polishing medium located at a planarizing surface of the polishing pad. The polishing machine also has a substrate carrier that may be positioned over the planarizing surface of the polishing pad, and at least one heat sensor is coupled to the polishing machine to detect heat at a front side of the substrate. The heat sensor preferably measures a temperature of a component sensitive to heat at the front side of the substrate, such as the planarizing surface of the polishing pad, the back side of the substrate, or the byproducts produced by polishing the substrate. In operation, the heat sensor monitors the heat at the front side of the substrate, and the removal of material from the substrate is stopped when the heat at the front side of the substrate changes from a first heat range to a second heat range.

**13 Claims, 4 Drawing Sheets**

## **[56] References Cited**

### **U.S. PATENT DOCUMENTS**

4,200,395 4/1980 Smith et al. .  
4,203,799 5/1980 Sugawara et al. .  
4,358,338 11/1982 Downey et al. .  
4,367,044 1/1983 Booth, Jr. et al. .  
4,377,028 3/1983 Imahashi .  
4,422,764 12/1983 Eastman .  
4,640,002 2/1987 Phillips et al. .  
4,660,980 4/1987 Takabayashi et al. .  
4,717,255 1/1988 Ulbers .  
4,879,258 11/1989 Fisher .  
5,036,015 7/1991 Sandhu et al. .  
5,064,683 11/1991 Poon et al. .  
5,069,002 12/1991 Sandhu et al. .  
5,081,796 1/1992 Schultz .  
5,154,021 10/1992 Bombardier et al. .  
5,216,843 6/1993 Breivogel et al. .  
5,220,405 6/1993 Barbee et al. .  
5,314,843 5/1994 Yu et al. .  
5,324,381 6/1994 Nishiguchi .

